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AC 150/5345-51

CHANGE 1

DATE 1/4/82

ADVISORY CIRCULAR

CHANGE

DEPARTMENT OF TRANSPORTATION
Federal Aviation Administration
Washington, D.C.

Subject: Change 1 to SPECIFICATION FOR DISCHARGE-TYPE FLASHING LIGHT EQUIPMENT--Revises Equipment Qualification Procedures

1. PURPOSE. This Change revises the procedures for obtaining equipment qualification approval as contained in paragraph 4.

2. EXPLANATION. Procedures for obtaining equipment qualification approval are now contained in AC 150/5345-1G, Approved Airport Lighting Equipment, and supersede those contained in paragraph 4 of this advisory circular.

3. FILING THIS CHANGE. This Change should be filed on the front of the advisory circular. Page changes to reflect this revision will be made at a later date.

Leonard E. Mudd
LEONARD E. MUDD
Director, Office of Airport Standards

Suggest filing this transmittal at the back of the AC. It will provide a reference authority for changes, a method of determining that all Changes have been received, and a check for determining if the AC contains the proper pages.

Initiated by: AAS-200

AC 150/5345-51

DATE 8/14/81

ADVISORY CIRCULAR

DEPARTMENT OF TRANSPORTATION
Federal Aviation Administration
Washington, D.C.

Subject: SPECIFICATION FOR DISCHARGE-TYPE FLASHING LIGHT EQUIPMENT

1. PURPOSE. This advisory circular contains the specifications for discharge-type flashing light equipment to be used for runway end identification lights (REIL) and for an omnidirectional approach lighting system (ODALS).

2. EFFECTIVE DATE. Effective March 1, 1982, only that equipment qualified in accordance with the specification in this advisory circular will be listed in AC 150/5345-1, Approved Airport Lighting Equipment.

3. METRIC UNITS. To promote an orderly transition to metric units, the specification includes both English and metric dimensions. The metric conversions may not be exact equivalents, and until an official changeover to metric units is effected the English dimensions will be used.

Leonard E. Mudd
LEONARD E. MUDD
Acting Director, Office of
Airport Standards

Initiated by: AAS-200

SPECIFICATION FOR DISCHARGE-TYPE FLASHING LIGHT EQUIPMENT

1. SCOPE AND CLASSIFICATION.

1.1 Scope. The discharge-type flashing light equipment covered by this specification is used for runway end identification lights (REIL) and for an omnidirectional approach lighting system (ODALS).

1.2 Classification. Two types and six styles of flashing light equipment are covered by this specification.

1.2.1 Types.

L-849 - Equipment for use as runway end identification lights (REIL).

L-859 - Equipment for use as an omnidirectional approach lighting system (ODALS).

1.2.2 Styles.

A - Unidirectional, high intensity, one brightness step.

B - Omnidirectional, high intensity, one brightness step.

C - Unidirectional, low intensity, one brightness step.

D - Omnidirectional, low intensity, one brightness step.

E - Unidirectional, three brightness steps.

F - Omnidirectional, three brightness steps.

All styles are applicable to Type L-849; only Style F is applicable to Type L-859.

2. APPLICABLE DOCUMENTS.

2.1 General. The following documents, of the issue in effect on the date of qualification application, form part of this specification and are applicable to the extent specified herein.

2.2 Federal Aviation Administration (FAA) Documents.

2.2.1 FAA Specification.

FAA-E-1100	Photometric Test Procedures for Condenser Discharge Lights
FAA-G-2100/1	Electronic Equipment, General Requirements, Part 1, Basic Requirements for All Equipment

2.2.2 FAA Standards.

FAA-STD-012 Paint Systems for Equipment

FAA-STD-013 Quality Control Program Requirements

2.2.3 FAA Advisory Circulars.

AC 150/5345-1 Approved Airport Lighting Equipment

AC 150/5345-10 Specification L-828, Constant-Current Regulators

2.3 Military and Federal Publications.

2.3.1 Military Specification.

MIL-C-7989 Covers, Light Transmitting, for Aeronautical Lights, General Specification for

2.3.2 Military Standard.

MIL-STD-810 Environmental Test Methods

2.3.3 Federal Standard.

FED-STD-595 Colors

2.4 American National Standards Institute (ANSI) Publication.

ANSI C37.90 Relays and Relay Systems Associated with Electric Power Apparatus

(Copies of FAA specifications and standards may be obtained from the Federal Aviation Administration, Airway Facilities Service, Washington, D.C. 20591.)

(Copies of FAA advisory circulars may be obtained from the Department of Transportation, Publications Section, M-443.1, Washington, D.C. 20590.)

(Requests for copies of military specifications and standards should be addressed to the Commanding Officer, Naval Supply Depot, 5801 Tabor Avenue, Philadelphia, Pennsylvania 19120.)

(Information on obtaining copies of Federal standards may be obtained from General Services Administration offices in Washington, D.C.; Atlanta; Boston; Dallas; Denver; Kansas City; New York; San Francisco; and Seattle.)

(Copies of ANSI publications may be obtained from the American National Standards Institute, 1430 Broadway, New York, New York 10018.)

3. REQUIREMENTS.

3.1 Equipment to be Supplied by the Manufacturer. Each flashing light system shall be complete in accordance with all specification requirements and shall include the items listed below:

a. Control unit (one per system).

b. Optical assembly, consisting of an optical head and a power supply (two for Type L-849 systems and seven for Type L-859 systems).

c. Instruction manual (one per system).

3.1.1 Connecting Cables. Cables for connecting between the control unit and optical assemblies or between the optical head and power supply when installed remotely (3.5.2) are not included in this specification. However, the instruction manual shall provide sufficient information to guide the installer in selecting the proper cables.

3.2 System Description. The flashing light equipment specified herein is used on airports to provide visual guidance to pilots during approach for landing. In a REIL configuration, one light is installed on each side of the runway to identify the threshold (approach end) of the runway. These two lights flash simultaneously. In an ODALS configuration, five of the lights are installed on the extended runway centerline to provide guidance in lining up the runway. These lights flash in sequence and appear as a ball of light traveling toward the runway threshold. The other two lights of the ODALS are installed in a REIL configuration and flash simultaneously after the last flash of the centerline lights.

3.3 Environmental Requirements. The equipment shall be designed for outdoor installation and operation under the following environmental conditions:

a. Temperature. Temperatures which range from plus 55 degrees C to minus 55 degrees C.

b. Altitude. A pressure altitude range from sea level to 10,000 feet (3000 m).

c. Temperature Shock. Exposure of light-emitting surfaces to sudden application of cold water when the optical head has reached its operating temperature.

d. Humidity. A relative humidity up to 100 percent including conditions where condensation takes place in the form of water or frost.

e. Salt Spray. Exposure to salt-laden atmosphere.

f. Sand and Dust. Exposure to windblown sand and dust particles.

g. Rain. Exposure to windblown rain.

h. Wind. Wind velocities up to 150 knots.

3.4 Photometric Requirements.

3.4.1 Effective Intensity. The optical assemblies shall meet the effective intensity requirements listed in table 1 within a tolerance of 50 percent for the following beam patterns:

a. Styles A, C, and E - 10 degrees vertical by 30 degrees horizontal.

b. Styles B, D, and F - 2 to 10 degrees vertical by 360 degrees horizontal.

The effective intensity shall be maintained when the equipment is operated within 10 percent of the design input voltage or when operated at design input voltage and subjected to the temperature range in 3.3a. Light output below the vertical cutoff points should be minimized for environmental purposes.

Table 1. Ef fective intensity requirements .

Type	Style	Effective intensity (candelas) Brightness step		
		High	Medium	Low
L-849	A	15,000	--	--
L-849	B	5,000	--	--
L-849	C	--	--	700
L-849	D	--	--	700
L-849	E	15,000	1,500	300
L-849	F	5,000	1,500	300
L-859	F	5,000	1,500	300

3.4.2 Flash Rate, Type L-849. Both optical assemblies shall flash simultaneously (no more than a 20-millisecond separation) at a rate of 90 plus or minus 30 flashes per minute.

3.4.3 Flash Rate, Type L-859. The optical assemblies shall flash at a rate of 60 flashes per minute within a tolerance of 10 percent. The flash sequence shall start with the optical assembly located the farthest from the runway threshold, and subsequent assemblies shall flash in sequence toward the runway threshold. The interval between flashes of the centerline assemblies shall be 1/15 second. The interval between flashes of the last centerline optical assembly and the simultaneous flashes of the two optical assemblies in the REIL configuration shall be 4/15 second. The interval between the flashing of the optical assemblies in the REIL configuration and the start of a new cycle shall be 7/15 second. All flash intervals shall be within 10 percent of the specified time.

3.4.4 Color of Light. The color of light emitted by the optical assemblies shall be equivalent to that produced by a xenon gas discharge lamp.

3.5 Equipment Design Requirements.

3.5.1 General Operating Requirements. The flashing light systems shall be suitable for continuous operation. Style E and F systems shall have three intensity set-

tings--"high", "medium", and "low". All systems shall have provisions for local and remote control as specified in 3.5.4. Intensity changes shall be completed within 1.5 seconds after initiating the command. The power input to the optical assembly may be interrupted during intensity step changes. The design of the system shall prohibit random flashing.

3.5.2 Optical Assembly. The optical assembly consists of an optical head and a power supply. The Type L-849 optical head shall be attached to the power supply enclosure. Type L-859 optical heads shall be capable of being attached to the power supply enclosure or installed remotely up to 150 feet (45 m) from the power supply. Brackets shall be provided for mounting the optical head directly to the power supply enclosure or onto a single vertical 2-inch E.M.T. conduit for remote locations. The Type L-859 optical head shall weigh a maximum of 12 pounds (5.5 kg). When installed, the overall height of the Type L-849 optical assembly shall not exceed 34 inches (0.85 m) above grade. Frangible mounting hardware shall be provided for Type L-849 optical assemblies and for Type L-859 optical heads mounted on 2-inch E.M.T. conduit.

3.5.2.1 Flash Tube. The flash tube shall operate without failure for at least 1,000 hours while meeting the flash rate and photometric requirement of the high intensity mode. The effective intensity shall not decrease more than 30 percent during this time period, and flash skipping (misfirings) shall be less than 1 percent with no skips occurring consecutively.

3.5.2.2 Power Supply. The power supply provides power and triggering pulses to the optical head. The enclosure for the power supply shall be raintight and be sufficiently rigid to allow mounting by means of conduit leg(s) and frangible coupling(s). Power supply enclosures shall be equipped to support the optical head.

3.5.2.3 Aiming and Leveling. Style A, C, and E optical heads shall be designed so that the light beam may be aimed in a vertical and a horizontal plane. A positive locking device shall be provided to prevent accidental movement of the optical head after aiming. The optical head shall be adjustable vertically from 0 to 15 degrees and horizontally 15 degrees each side of a zero reference point. The scales shall be graduated in not more than 1-degree increments. Style B, D, and F optical heads shall have provisions to permit adjustment, after installation, of up to 6 degrees for leveling.

3.5.3 Control Unit. The control unit powers and controls the individual optical assemblies. The control unit shall be designed to operate from a 120/240 volt source or optionally from other standard commercial voltages. The control unit shall be housed in a NEMA type 4 enclosure or equal with a hinged door. The door shall open from the right side and have provisions for padlocking. Terminal blocks shall be located near the side or bottom of the enclosure for termination of external power and control wires feeding into the control unit. Mounting lugs or bolts shall be provided on the back of the enclosure to allow vertical mounting. At the manufacturer's option, the control unit for Type L-849 equipment may be housed in one of the optical assembly power supply enclosures. A service entrance switch, used to disconnect the incoming power to the control unit, shall be furnished with the control unit. If the switch is mounted external to the control unit enclosure, it shall be a type designated for outdoor application and have locking provisions.

3.5.3.1 Elapsed Time Meter. An elapsed time meter may be installed as an option to indicate the number of hours of operation on the high intensity step position. The meter shall indicate elapsed time in hours and tenths of hours up to 999 hours. The meter shall be a recycling type and shall be equivalent to General Electric type 909x85.

3.5.3.2 Series Circuit Adapter. An optional adapter may be provided to allow the system to be powered by a series lighting circuit which is energized by a constant current regulator as described in AC 150/5345-10, Specification L-828, Constant Current Regulators, current edition. The system shall be capable of operation at all regulator brightness steps, and shall be compatable with all approved regulator designs. Approved regulator manufacturers (listed in AC 150/5345-1, Approved Airport Lighting Equipment) will make available oscilloscope photographs of the output waveforms of their regulators; the manufacturer of the flashing light equipment is responsible for compatibility. The constant current adapter circuitry may be incorporated into the control unit or may be in a separate enclosure. Any auxiliary enclosure must pass all environmental tests.

3.5.4 System Control.

3.5.4.1 Local Control. All systems shall have local control capability located in the control unit for maintenance purposes. For Styles A, B, C, and D, a three-position switch with "REMOTE", "ON", and "OFF" functions shall be provided. These positions shall perform functions analogous to those listed below. For Styles E and F, the switch shall be be a five-position rotary switch with mechanical detents, labeled as follows, to perform the indicated functions:

Switch Position	Function
REMOTE	System controlled (ON/OFF and intensity) by remote control.
OFF	Power and control circuits deenergized.
LOW	System operating at low intensity.
MEDIUM	System operating at medium intensity.
HIGH	System operating at high intensity*

3.5.4.2 Remote Control. Control units shall have provisions for remote control by a switch or by a radio receiver/decoder unit. For single intensity systems, on/off control is provided via 3 terminals (120 volts ac, On, and Neutral). For three intensity style systems, the following 5 terminals are provided:

a. Low intensity.

b. Medium intensity.

c. High intensity.

d. 120 volts ac.

e. Neutral.

3.5.4.2.1 Intensity-Step Switching. A 120-volt ac source terminal fused for a 150-watt load shall be provided to activate the remote-control switching network. For single-step style systems, the remote switch will close a circuit between the 120-volt source and an "on" terminal; the system will turn on when this terminal receives the 120-volt potential. For multiple-step systems, the 120-volt potential (on terminal "d") is provided only when the local control switch is in the "remote" position. The remote switching network will return the 120-volt potential to terminal "a", "b", or "c", and the system will turn on to the selected intensity. If more than one intensity terminal is energized, the system shall operate at the highest intensity selected.

3.5.5 Circuit Design. The circuit design and construction shall be in accordance with highest standards, with emphasis on reliability and long life. The brightness control circuit shall be designed such that it will revert to the lowest brightness setting in the event of failure.

3.5.6 Electrical Protection. The system shall be protected against electrical transients found in the airport environment as described below.

3.5.6.1 Transient Suppression. To protect against input powerline surges, the system shall withstand without operational interruption or damage a 50-millisecond pulse with a peak value of 500 volts superimposed on the input powerlines.

3.5.6.2 Dielectric Protection. When installed in an operational environment per manufacturer's instructions, the system shall withstand repeated application of a 5,000 volt potential between the equipment case (electrical ground) and any control or power conductor for a period of 10 milliseconds.

3.5.6.3 Lightning Protection. Lightning arresters shall be installed on all ungrounded conductors as near as possible to their point of entry to the control unit. The arrester's sparkover voltage shall be less than the unit's dielectric withstand rating (3.5.6.2). Telephone or gap-type arresters shall not be used.

3.5.6.4 Electromagnetic Interference (EMI). The system shall be designed to operate in an environment with equipment that is sensitive to EMI; therefore, the system shall not radiate or conduct excessive amounts of electromagnetic noise. Additionally, the system shall not be sensitive to EMI on the input lines or radiated noise from nearby equipment. EMI sensitive components, such as timers or controllers, should be adequately shielded or otherwise protected.

3.5.6.5 Interlock Switches. Interlock switches shall be incorporated in the control unit and power supplies so that opening the enclosure shall (1) disconnect incoming power and (2) discharge all voltages over 150 volts to 50 volts within 30 seconds. This discharge shall occur even if components which normally draw current from the high-voltage circuits are removed. In addition, the design shall include bleeder resistors to discharge the flash capacitor (if used) to 50 volts within 5

minutes if the interlock should fail. Means shall be provided to defeat the interlock with the door open for maintenance purposes. If an interlock is not provided on the optical head, a label shall be attached warning not to open the optical head until system power has been disconnected.

3.6 Materials and Parts. All materials used in fabrication of the flashing light systems shall be suitable for the intended purpose and adequately protected against corrosion. All assembly hardware, including screws, bolts, nuts, washers, and latches, shall be 18-8 stainless steel. All wiring and components shall have adequate capacity and shall not be operated in excess of the component manufacturer's recommended rating.

3.6.1 Covers. Light-transmitting covers for the optical heads shall conform to the requirements of MIL-C-7989, class A for glass and class D for plastic.

3.6.2 Gaskets. The gasket material used shall withstand the specified temperature range; also, any gasket material used in the optical head shall withstand exposure to ozone.

3.6.3 Special Component Requirements. All the materials used in the construction and assembly of components (including the insulation on wires) which are located in or near the optical head shall be ozone resistant. Flash capacitors shall be suitable for the application and shall have a life expectancy greater than 1 year in continuous operation at the actual working voltage.

3.7 Finish. The exterior of all units shall be painted with 3 coats of aviation orange paint, matching color No. 12197, Federal Standard 595. Interior surfaces shall be painted white. Painting shall be done in accordance with FAA-STD-012. Nonferrous enclosures will not require painting if the exterior material color matches aviation orange; otherwise the exterior surfaces shall receive the 3 coats of paint.

3.8 Assembly and Marking. All components shall be properly assembled and marked. Each electrical component or part thereof shall be identified by a reference designation marked adjacent to the physical location of the part of the equipment and readily visible to maintenance personnel. Such identification shall be identical to reference designations used in instruction books for the equipment. All wiring shall, where possible, be grouped, color coded, laced into cables, neatly clamped, and properly marked. Marking shall be in accordance with FAA-G-2100/1, paragraph 1-3.12.

3.9 Identification. Identification data shall be permanently affixed to each equipment unit (optical head, power supply, control unit, etc.) and shall contain at least the following information:

a. Name of unit (optical head, power supply, etc.).

b. Type and style.

c. Manufacturer's name and address.

3.10 Instruction Manual. An instruction manual shall be supplied as part of each system and shall contain the following information:

a. Safety precautions used while maintaining the equipment.

b. Theory of circuit and system operation.

c. Complete schematics and interconnecting wiring diagrams.

d. Complete parts list with each circuit component keyed to the designation assigned on schematics or wiring diagrams. Complete information shall be given for each part to permit ordering for replacement purposes. This information shall include the component's rating, name of the manufacturer, and the manufacturer's part number.

e. Recommended preventive maintenance.

f. Troubleshooting procedures.

g. Physical characteristics (weight, size, mounting dimensions).

h. Installation instructions.

i. Operating instructions*

4. QUALITY ASSURANCE PROVISIONS.

4.1 Qualification Requirements.

4.1.1 Qualification Request. Requests for qualification approval must be submitted in writing to the Office of Airport Standards, Attention: AAS-200, Federal Aviation Administration, Washington, D.C. 20591. This request must include:

a. A list of the types and styles of equipment, along with the manufacturer's catalog numbers, for which qualification approval is requested. A list of equipment options to be offered shall also be included.

b. A copy of proposed test procedures and test data sheets and a statement as to whether the manufacturer proposes to conduct the tests or name and location of an independent testing laboratory where the tests are to be conducted (4.1.2).

c. A copy of the manufacturer's proposed guarantee for the equipment (4.1.4).

d. A copy of the manufacturer's quality control plan (4.1.3).

e. A preliminary copy of the equipment instruction manual (4.1.5).

4.1.2 Qualification Testing. The equipment must pass all tests in 4.2. The manufacturer shall supply all test equipment and bear all testing costs. Tests may be conducted at the manufacturer's plant if facilities are available or at an independent test laboratory acceptable to the FAA. The FAA reserves the right to witness

any or all tests and shall be given 2 weeks' notice of testing. Where the FAA waives the option to witness tests, the manufacturer must submit a certified copy of all test reports.

4.1.3 Quality Control Provisions. The manufacturer shall provide and maintain a quality control progam in accordance with FAA-STD-013 except that facilities for an FAA Quality Assurance Representative are not required.

4.1.4 Guarantee. The manufacturer shall provide the following minimum guarantee for each equipment: That the equipment has been manufactured and will perform in accordance with this specification and that any defect in material or workmanship which may occur during proper and normal use during a period of 1 year from date of initial operation or a maximum of 2 years from date of shipment will be corrected by repair or replacement by the manufacturer f.o.b. factory.

4.1.5 Instruction Manual. The preliminary instruction manual will be reviewed to assure compliance with 3.10, and recommended changes, if any, will be forwarded to the manufacturer. The manufacturer shall incorporate recommended changes and submit 8 copies of the final instruction manual to the FAA prior to receiving qualification approval. These instruction manuals will be used by FAA personnel to monitor equipment as delivered to insure against nonapproved modifications to the equipment.

4.1.6 Qualification Approval. Manufacturers who have met all requirements specified herein will be listed as approved suppliers in AC 150/5345-1, Approved Airport Lighting Equipment. Once approval has been granted, the manufacturer may not make any changes in the equipment without prior FAA approval. Requests for design or component changes must be submitted to the office listed in 4.1.1 and must be accompanied by supporting documentation for the change plus 8 copies of revised instruction manual pages which reflect the proposed change. Substitution of components which are identical in rating and size and equal or better in quality does not require prior FAA approval.

4.2 Test Procedures. The environmental tests specified in the following paragraphs shall be conducted on a system (a control unit and at least one optical assembly). Operational tests required during or after environmental tests as specified in the particular test methods shall consist of at least one operational cycle as specified in 4.2.12 with all test components connected together. Where tests are conducted on an abbreviated system (one without a complete complement of optical assemblies), the load imposed by the missing components and their interconnecting cables shall be simulated by equivalent circuits. Test results, including derating data, shall be submitted with the request for qualification.

4.2.1 ~~Altitude Test~~. The test shall be in accordance with Method 504.1, of MIL-STD-810 for Category 2 equipment with the following modification to Table 504.1-II: Omit steps 1a, 6, 8, and 11; change temperature of step 1b to -55 degrees C, and step 10 to 55 degrees C.

4.2.2 Thermal Shock Test. The equipment shall be installed as in normal use and operated at maximum intensity until the temperatures have stabilized. Water at a temperature of 25 $\pm$ 5 degrees C shall be applied in droplets, having a diameter

range between 0.5 and 4.5 millimeters, to the light face. There shall be no cracking of glass, metal, or plastic as a result of this test.

4.2.3 Humidity. The test shall be in accordance with Procedure I, Method 507, of MIL-STD-810, except a total of three complete cycles (72 hours) will be required and the maximum temperature is 55 degrees C.

4.2.4 Sand and Dust Test. The test shall be in accordance with Procedure I, Method 510, of MIL-STD-810, except steps 2 and 3 shall be deleted. The equipment shall be rotated 120 degrees twice, and the air velocity shall be 2,500 ± 500 feet (760 ± 150 m) per minute.

4.2.5 Rain Test. The test shall be in accordance with Procedure I, Method 506, of MIL-STD-810.

4.2.6 Wind. An optical head mounted to a power supply enclosure and one mounted to a 2-inch E.M.T. conduit shall be subjected to a 150-knot wind applied perpendicular to the optical head face. Distress or damage to any part of the assembly shall be cause for rejection.

4.2.7 Salt Spray Test. The test shall be in accordance with Procedure I, Method 509, of MIL-STD-810 for not less than 168 hours. Salt buildup as a result of the test may be removed with tap water. Deterioration of any part preventing the system from meeting functional, service, and maintenance requirements or surface derogation shall be cause for rejection.

4.2.8 Transient Suppression Test. The control unit and one optical assembly shall be tested for conformance with the requirements specified in 3.5.6.1. The test method shall be developed using ANSI C37.90 as a guide.

4.2.9 Visual Inspection. The equipment shall be visually inspected for workmanship, fabrication, finish, painting, and adequacy of selected parts.

4.2.10 Photometric Tests, Photometric tests shall be conducted on equipment to determine compliance with 3.4. Photometric tests shall be conducted in accordance with FAA-E-1100, Photometric Test Procedures fur Condenser Discharge Lights., Test results shall include a graph showing the isocandela curve of effective intensity for each brightness setting and oscilloscope photographs of the discharge pulse shape.

4.2.11 Dielectric Test. A dielectric test shall be made on power and control wiring of the qualification system, The test shall be made by applying both psitive and negative 5 kV pulses, of a duration of a% least 10 milliseconds, between input power and control wires and ground (equipment case). The test shall continue until 10 pulses have been applied during a 10-second interval or until a 5 kV dc voltage has been applied for 10 seconds, The equipment shall be capable of normal operation after this test, After completion of the dielectric test, a 1,000-volt dc insulation tester shall be used to check the same points. The resistance to ground, as observed with the insulation tester, shall not be less than 300 megohms. Components not designed for the high voltage of the insulation tester: such as

capacitors, rectifiers, printed circuit; boards, etc., may be disconnected for this test, Production units need only be checked with the insulation tester.

4.2.12 Operational Tests. All components which will be part of a particular system shall be connected together when undergoing operational tests. For qualification testing, the components shall be interconnected with the maximum length of interconnecting cable specified (3.5.2). Operation of the interlock switches shall be verified. All operating requirements of the equipment shall be checked over the full range of input voltage variations at the control unit power input terminal. The brightness switching operation of the components shall be verified through the remote control inputs provided in the control unit.

4.2.13 Eighty-Hour Test. An 80-hour continuous operation test shall be performed on the system. All intensities shall be checked using the remote control inputs to cycle the system as described below, with a 10 percent tolerance on the time intervals specified.

a. Low Intensity - 5 minutes.

b. Off - 2 seconds.

c. Medium Intensity - 5 minutes.

d. Off - 2 seconds.

e. High Intensity - 5 minutes.

f. Off - 60 seconds.

g. Repeat Cycle, starting with a.

The local control switch shall be manually cycled through the off, low, medium, and high intensity step positions a minimum of 20 times at the completion of the 80-hour test. Flashtubes used in the 80-hour test shall not be shipped as part of the equipment but shall be replaced with new flashtubes.

4.3 Production Tests, Production units shall be subjected to the fallowing tests:

a. Visual Inspection. (4.2.9).

b. Photometric Test. Style A, C, and E production units shall be checked at the beam center, ± 15 degrees horizontally from the beam axis, and ± 5 degrees vertically from the beam axis; Style B, D, and F production units shall be checked at 2, 6, and 10 degrees vertically for maximum and minimum points to determine compliance with 3.4.1.

c. Dielectric Test. (4.2.11).

d. Operational Test. (4.2.12).

e. Five-and-One-Half-Hour Test. All production units shall have a 5 1/2-hour continuous operational test performed on them using the remote control inputs as follows:

(1) High Intensity - 5 hours, minimum.

(2) Cycle 4.2.13 a through g - one-half hour, minimum.

The local control switch shall be manually cycled through the off, low, medium, and high intensity positions a minimum of 20 times at the completion of the 5 1/2-hour test.

f. Failures. Units failing any part of the production test must be repaired and undergo a complete retest under 4.3.